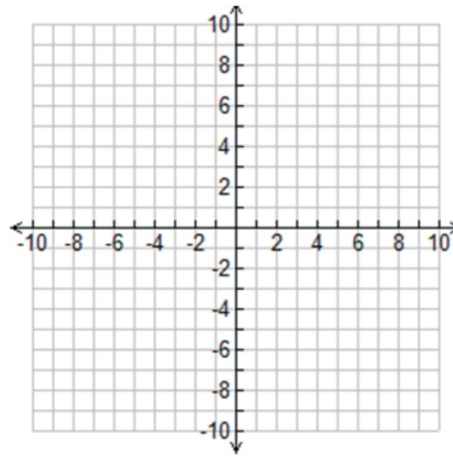


$$x^3 - 7x^2 - 18x$$

$$x(x^2 - 7x - 18)$$

$$\sqrt{(x-9)(x+2)}$$



$$x^3 - 36x$$

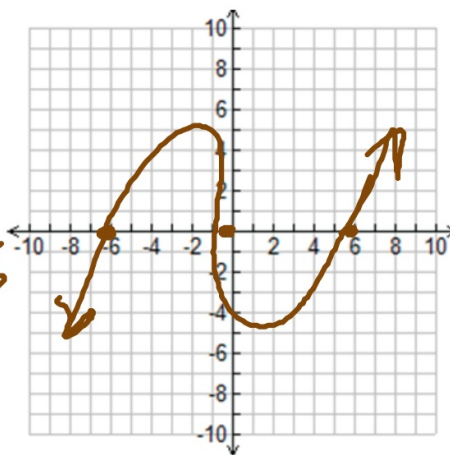
$$x(x^2 - 36)$$

$$x(x-6)(x+6)$$

$$x=0 \quad x=6 \quad x=-6$$

$$y \text{ int} = (0,0)$$

$$E.B. \text{ odd} (+)$$



**Bellwork: 2/12/13**

Graph the following function:

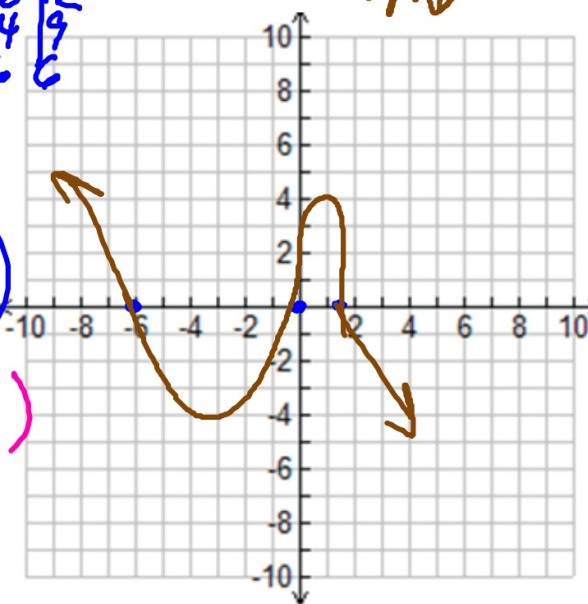
$$y = -4x^3 - 18x^2 + 36x$$

$$\begin{array}{r} -36 \\ -1 \overline{) 36} \\ -2 \overline{) 18} \\ -8 \overline{) 12} \\ -4 \overline{) 9} \\ -6 \overline{) 6} \end{array}$$

$y_{int} = (0,0)$   
E.B. odd  $\ominus$   
 $\uparrow \downarrow$

$$\begin{aligned} & -2x(2x^2 + 9x - 18) \\ & (2x^2 + 12x - 3x - 18) \\ & 2x(x+6) - 3(x+6) \\ & (2x-3)(x+6) \\ & -2x(2x-3)(x+6) \end{aligned}$$

$$\begin{aligned} -2x &= 0 & 2x-3 &= 0 & x+6 &= 0 \\ x &= 0 & x &= \frac{3}{2} & x &= -6 \end{aligned}$$



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### Section 5.2 - Multiplicity of roots:

If a root happens more than once in a polynomial function, then in order to keep the end behavior required, the graph must "bounce off" that root instead of going through it.

example 1:  $y = (x+3)^2(x-1)(x-2)$

$$(x+3)(x+3)(x-1)(x-2)$$

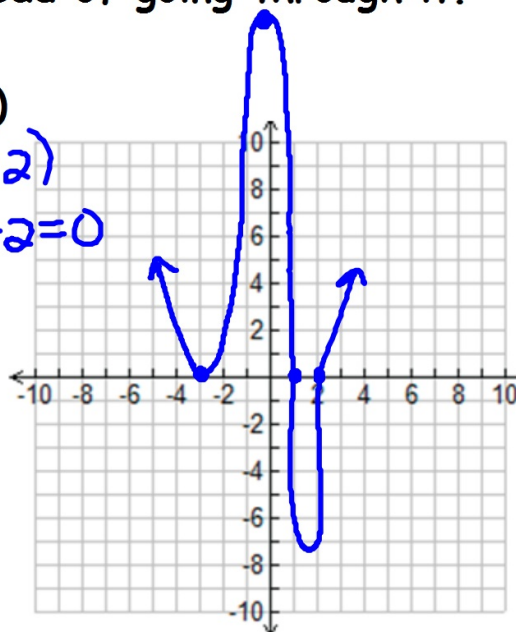
roots:  $x+3=0$   $x+3=0$   $x-1=0$   $x-2=0$

$$x = \textcircled{-3, -3}, 1, 2$$

y-intercept:

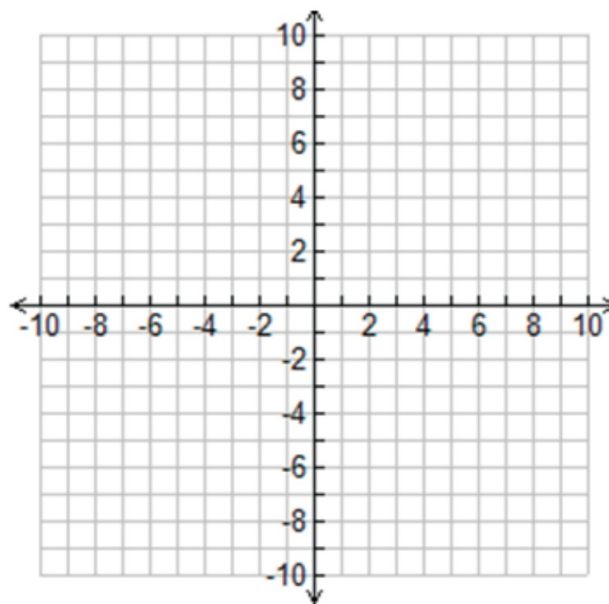
$$\begin{aligned} & (0+3)(0+3)(0-1)(0-2) \\ & (0, 18) \end{aligned}$$

end behavior:  $x^4$  even  $\oplus$   
 $\uparrow \uparrow$



Page 4

2)  $y = x^4 - 2x^3 - 8x^2$



3)  $y = \cancel{x^3 - 4x^2 + 4x}$

$x^3 - 8x^2 + 16x$

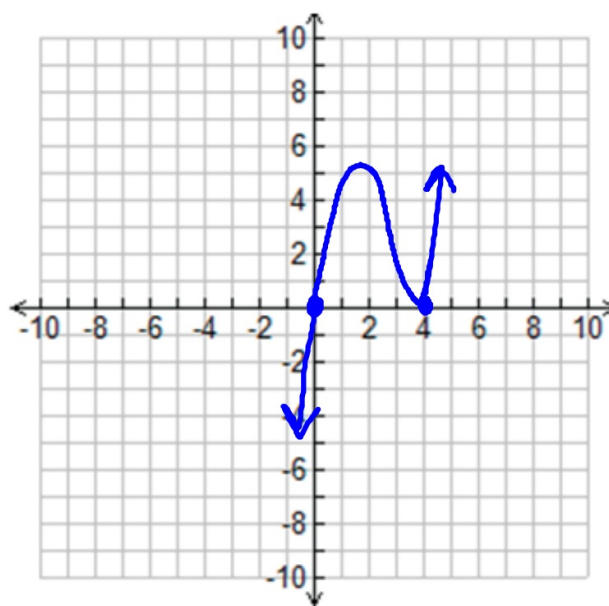
$x(x^2 - 8x + 16)$

$x(x-4)(x-4)$

roots:  $x=0$   $x-4=0$   $x-4=0$   
 $0, 4, 4$   
 twice

yint:  $0^3 - 8(0)^2 + 16(0)$   
 $(0, 0)$

EB:  $x^3$  odd  $\oplus \downarrow \uparrow$



### THE EXCEPTION:

4)  $y = -x^5 - 8x^4 - 16x^3$

$$-x^3(x^2 + 8x + 16)$$

$$-x^3(x+4)(x+4)$$

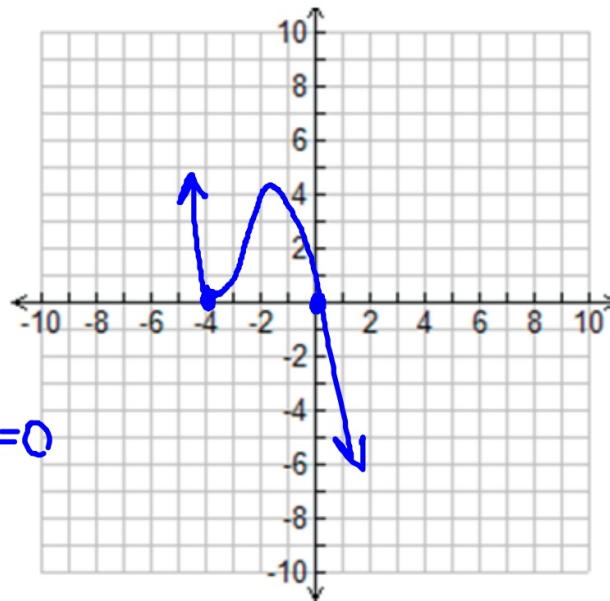
$$-x \cdot x \cdot x(x+4)(x+4)$$

$$-x=0 \quad x=0 \quad x=0 \quad x+4=0 \quad x+4=0$$

Roots:  $(0,0,0)$   $(-4,-4)$   
three twice

yint:  $(0,0)$

EB: odd  $\ominus$   $\uparrow \downarrow$



Therefore....

### RULES FOR MULTIPLICITY:

If the root happens an EVEN number of times, you bounce off it.

If the root happens an ODD number of times, continue through it.

**Homework: pg 293 #27-34 - find roots and MUST graph**

